Regional Operational Plan CF.3A.2014.02

Lower Kuskokwim River Tributary Escapement Investigations, 2014

by

Kevin L. Schaberg

March 2014

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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Alaska Department of Fish and Game, Commercial Fisheries, Anchorage

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Commercial Fisheries

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Signature Page

Project Title:	Lower Kuskokwim River Escapement Investigations, 2014.
Project leader(s):	*Kevin Schaberg*
Division, Region and Area	Commercial Fisheries, RIII, Kuskokwim
Project Nomenclature:	State of Alaska Chinook Initiative Funds
Period Covered:	January 2014-December 2016
Field Dates:	July 15 –Aug 20, Annually 2014-2016
Plan Type:	Category I

Approval

Title	Name	Signature	Date
Project leader	Kevin Schaberg		3/17/14
Research Coordinator	Jan Conitz		3-17-2014

Chinook Salmon Research Initiative Approval

Title	Name	Signature	Date
Fish and Game Coordinator	Ed Jones		3.25.14
Fisheries Scientist	Robert Clark		3/25/14
Fisheries Scientist	Eric Volk		3-26-14

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PURPOSE

Kuskokwim River Chinook salmon is 1 of 12 indicator stocks chosen by ADF&G. Assessment of total adult return is a significant component to understanding Chinook salmon production in this system. Region III Commercial Fisheries will conduct helicopter surveys in the lower Kuskokwim River to estimate escapement to this region. Lower Kuskokwim River escapement is necessary component to reconstruct total return on an annual basis. Other components of the annual return estimate are either available, or are incorporated in additional planned operations with the intent of producing total return estimates.

Management relies on recent advances in modeling Kuskokwim River Chinook salmon total returns, which in turn, rely upon accurate independent estimates of total return to scale the model (Bue et al. 2012). One of the most significant sources of uncertainty in reconstructing the total return is estimation of escapement to lower Kuskokwim River tributaries (Schaberg et al. 2012). There are two weirs (Kwethluk and Tuluksak rivers) in the lower Kuskokwim River; however there are several streams that are not monitored with weirs. The current method for estimation of the entire lower Kuskokwim River relies on available habitat area of each tributary to estimate productivity as S_{msy} using the allometric relationship between estimates of S_{msy} and watershed area for systems along the West coast of North America (Parken et al. 2006). The ratio of estimates of S_{msy} between one system of unknown escapement to one of monitored escapement, allowed for scaling escapement from the monitored weir projects to estimate escapement in unmonitored systems. Due to potential differences in habitat quality among the tributaries of the lower Kuskokwim River, it is possible that the ratios used to expand know escapement counts, based solely on watershed area, are biased.

This project will directly investigate relative escapement, through multiple helicopter counts of each tributary, across the three most significant spawning tributaries in the lower river (based on current estimates). These counts will be compared with the productivity ratios from the habitat method to identify if there similarities between the estimates. The ratio of counted escapement among the three systems will be investigated as an expansion factor for the unmonitored system, using Kwethluk weir as the surrogate.

OBJECTIVES

The objectives of this project in 2014 are to:

1. Develop ratios of relative escapement between each of the Kisaralik and Eek rivers and Kwethluk River, using aerial survey counts.
2. Estimate escapement in the Kisaralik and Eek rivers by multiplying the ratios of relative abundance obtained in Objective 1 and the annual Kwethluk River weir count.

METHODS

A contracted R44 helicopter will fly an ADFG observer over the Kisaralik, Kwethluk, and Eek rivers, to include the mainstem and all significant tributaries of each river (Figure 1). Flights will be conducted at an elevation of 100-300 ft, and airspeed of 20-45 mph. Counts will start at the lowest point in each drainage that visibility allows, and continue upstream until passage barriers are encountered or the stream becomes too small and overgrown to count. All significant tributaries of each river will be flown in the same manner. Survey area will be determined during the first survey, and demarked with GPS coordinates. Subsequent surveys will cover the same areas. Surveys will be conducted across all three rivers as close in time as weather will allow (3 days), to capture similar stages in arrival time of Chinook salmon to spawning grounds at each system. It is assumed that due to the similar geographic location of these rivers in the Kuskokwim drainage, run timing should be similar. Three separate surveys, conducted by a consistent observer, will be flown from July 15 to August 20 to ensure peak spawning is observed for each system. This time period was selected based on run timing observed in these and other area rivers during fixed wing escapement surveys in recent years.

In each survey, one observer will sit in the front seat next to the pilot with the ability to count through the nose window, so the aircraft can be positioned more directly over each stream. The surveyor will wear polarized glasses throughout the survey to reduce glare. The observer will count all Chinook salmon using a tally counter and record them for each river. All Chinook salmon will be recorded as live or carcasses and the combined total will be considered the count for each survey. When aggregations of fish are encountered, the pilot will be instructed to hover near the aggregation, to allow for accurate enumeration. The surveyor will also record survey condition data (wind, cloud cover, water clarity, water visibility, bottom coloration, sun angle, and spawning stage) and rate the survey as Good, Fair, or Poor, consistent with existing aerial survey protocols in place for management surveys. This is important as comparing results across the three rivers during each survey will be dependent upon the rivers having similar conditions. If conditions are different among the rivers during the same survey period, comparability will be considered to be compromised.

For each survey period with consistent conditions across the three rivers, we will develop ratios of escapement relative to the Kwethluk River survey count for Kisaralik and Eek rivers. The survey period that is identified to be nearest to peak escapement will be selected for comparison with the watershed area based relative production ratios (Schaberg et al. 2012; Table 1). Consistency in the ratios among each method would indicate the watershed area based method may be appropriate, and a more cost effective means to estimate escapement. A finding that these ratios would differ greatly would indicate that the aerial observation method may be more appropriate than the watershed area method for developing ratio expansion factors to estimate total lower Kuskokwim River Chinook salmon escapement. Estimates of escapement for the Kisaralik and Eek rivers will be made by multiplying each escapement ratio to the Kwethluk River weir escapement count. These estimates will then be compared with those from the habitat based method. Consistency among the relative escapement ratios would be an indicator of stable differences in productivity among the three systems, meaning escapement estimates from the expansion could allow for more accurate estimation of lower Kuskokwim River Chinook salmon on an annual basis.

SCHEDULE AND DELIVERABLES

Date	Activity
January	Set up contract with helicopter for upcoming season
July 15 – Aug 20	Aerial counts
September	Compile data, Analysis
Oct-Dec	Report of results

RESPONSIBILITIES

Kevin Schaberg	Supervise project, coordinate contracting, logistics, data analysis
Aaron Tiernan	Aerial survey observer, data collection

REFERENCES CITED

Bue, B. G., K. L. Schaberg, Z. W. Liller and D. B. Molyneaux. 2012. Estimates of the historic run and escapement for the Chinook salmon stock returning to the Kuskokwim River, 1976-2011. Alaska Department of Fish and Game, Fishery Data Series No. 12-49, Anchorage.

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Schaberg, K. L., Z. W. Liller, D. B. Molyneaux, B. G. Bue and L. Stuby. 2012. Estimates of total annual return of Chinook salmon to the Kuskokwim River, 2002–2007. Alaska Department of Fish and Game, Fishery Data Series No. 12-36, Anchorage.

Table 1.–Estimates of lower Kuskokwim River tributary productivity ratios, derived from habitat based estimates of S_{msy}; From Schaberg et al. 2012.

	Watershed Area (km^2)	[a] S_{msy}	S_{ux}/S_m
Kwethluk River (S_m)	1,439	3,285	
Eek River (Above tidal) (S_{u1})	1,655	3,619	1.102
Kisaralik River (S_{u2})	2,495	4,808	1.464

[a] S_{msy} was calculated from Parken et al. (2006) based on watershed area. S_{msy}= exp(0.6921884 ln(watershed area km2)+2.917216+(0.293/2)).

Figure 1. Map of Lower Kuskokwim River, with tributary systems that will be surveyed in 2014-2016 highlighted.